



## The decisions we make today **will shape tomorrow.**

One third of the global safe carbon budget will be determined by urban policy decisions in the next five years.

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## One third of the world's remaining safe carbon budget could be determined by urban policy decisions in the next five years.

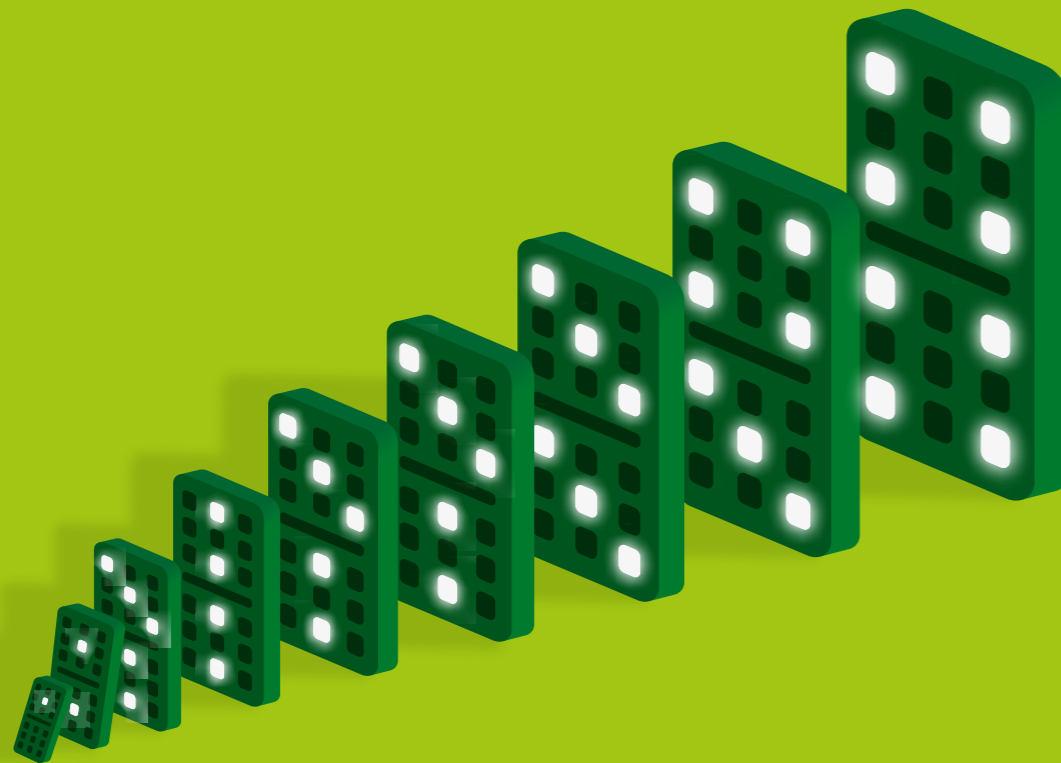
This document draws from the main findings of a ground breaking new report by C40 and the Stockholm Environment Institute (SEI), which demonstrates that urban policy decisions before 2020 could determine up to a third of the remaining global carbon budget that is not already 'locked-in' by past decisions. Existing research has shown that investing in low carbon infrastructure in the next five years will be four times less expensive than building high carbon infrastructure now, and then having to replace it in the future. Mayors and local leaders in power today thus have a major role to play in determining whether or not we have a cost-effective and, therefore, realistic path to a climate safe world.

Scientists have previously calculated that we can emit a 'carbon budget' of just 1,000 Gt CO<sub>2</sub> without creating an unacceptable risk of run-away climate change, and that much of this budget may already be locked-in by investments such as fossil fuel power stations, highways and energy-hungry buildings that have already been made.

Previous research has suggested that decisions about the remaining investments will be taken in the next five years, by 2020. Fortunately, C40 and SEI's new analysis shows that a third of the decisions will be made in cities, meaning local leaders in office right now, many of whom have already demonstrated leadership on climate change, can grasp the opportunity to move on to a low-carbon path.

Negotiations for a critical new climate treaty, taking place in Paris this December at COP21, concern action to be taken after 2020. But mayors can, and are, taking action right now. Over half of all C40 cities have committed to the Compact of Mayors, a global platform where cities publish their current emissions inventories and commit targets and action plans to cut future emissions. Hundreds more cities around the world are following suit and making ambitious commitments. None need to wait for the outcome of treaties and talks to take action.

This new report is thus both a major boost in on-going efforts to deliver a climate safe world, and provides further evidence that there needs to be a major focus on supporting mayors and action in cities.



1.5 million new urban dwellers every week



Nearly a 1/3 of the remaining 'safe' carbon budget will be determined by cities



Five years to avoid locking in dangerous global warming

## As urban populations grow, cities will play a pivotal role in moving us towards a low carbon development path.

The world is becoming ever more urban, with 1.5 million people moving into towns and cities every week, all requiring infrastructure like homes, roads, electricity and water supplies. As a result, the approach taken to urban infrastructure construction, renewal and refurbishment will play a substantial role in avoiding or locking in future emissions. For example, hundreds of millions of new homes will either produce large quantities of greenhouse gas (GHG) emissions through poor energy performance, or avoid emissions through sensible and efficient design.

This report is the first to quantify the extent to which urban development decisions made in the near future will set the course for high or low carbon development in the long term. **It estimates that close to one-third of our remaining global carbon budget, that is not already 'locked-in', will be influenced by urban development decisions made in the next five years.**

### Carbon Lock-in

"Locked-in" emissions are those associated with investments or policy decisions made to date, but with emissions consequences for the future. For example, once the decision is taken to build a new coal-fired power station, we can calculate the likely emissions that will result over its whole lifecycle, which can be considered 'locked-in' once the plant is constructed. This can mean that continued high carbon investments can lock in large volumes of carbon emissions many years before they are actually released. This is important when considering how to stay within set carbon budgets.

There are opportunities to mitigate or "unlock" emissions from existing infrastructure, although in many cases this can be challenging. Existing urban buildings with poor energy performance can be refurbished or retrofitted. Better insulation and more efficient heating systems can be installed. Or in the case of urban transport infrastructure, highways devoted exclusively to private motor vehicles can have one or more lanes given over to public transport such as trams or bus rapid transit (BRT).

## Transformative action is needed urgently. If we carry on as we are, within just five years we will have locked-in enough carbon to exceed an agreed limit of 2°C warming.

Based on current trends of infrastructure construction, the world could lock in its entire carbon budget by 2020. That is, in less than five years time, we will have built enough roads, power stations and buildings required to push us over 2°C of warming. This is according to evidence from the International Energy Agency<sup>1</sup> and others.

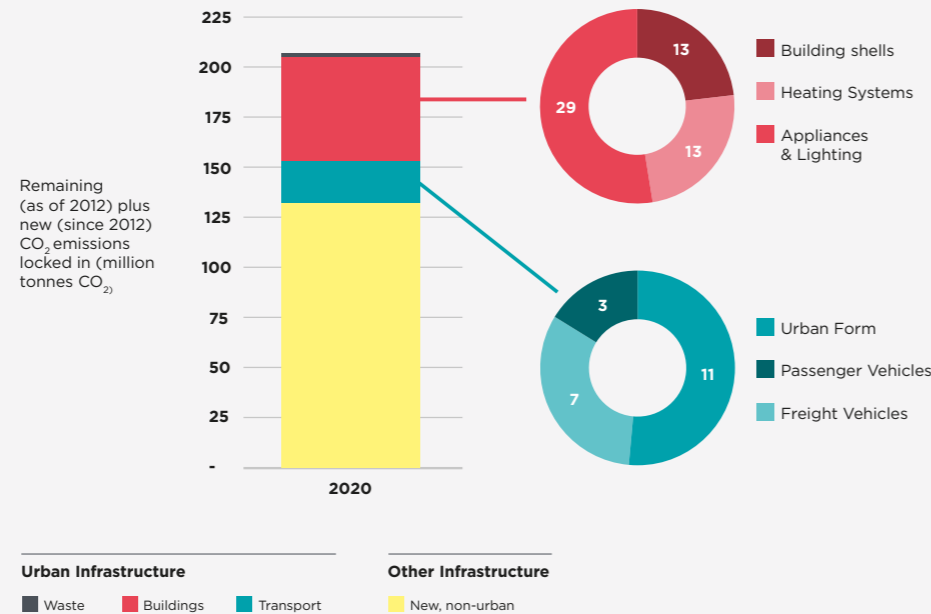
### Carbon Budget

To determine how to avoid a 2°C rise in global average temperatures above the pre-industrial average (the so-called 'safe' level), scientists have calculated a 'carbon budget' estimated at 1,000 Gt CO<sub>2</sub> from 2012. This is the total amount of greenhouse gas emissions we can risk putting into the atmosphere this century.

<sup>1</sup> <http://www.iea.org/publications/freepublications/publication/english.pdf>

Eighty per cent of this carbon budget has been judged by previous studies to be 'locked-in' by decisions that have already been taken. Our study focuses on the remaining carbon budget of 200 Gt CO<sub>2</sub>, and how this budget will be "used up" based on current trends of infrastructure development, assuming continuation of business as usual. Figure 1 shows the results of this analysis, and the finding that urban infrastructure investment could account for 31% of that budget.

**Figure 1: Business-as-usual urban contribution to the remaining carbon budget**



Cities have an opportunity to pursue a low carbon pathway

If cities continued on a business as usual trajectory to 2030, future emissions committed by new urban buildings and transport infrastructure would average about 14 Gt CO<sub>2</sub> annually over the next 15 years. Primary contributors are the construction of inefficient buildings, development of sprawling urban form, and purchase of inefficient appliances and vehicles. New buildings – and new equipment within existing buildings – represent the strong majority (>70%, or almost 10 Gt CO<sub>2</sub> annually) of future urban emissions committed. Half of this is due to numerous individual investments in building appliances and lighting. Heating and cooling, including what is locked in by inefficient building shells, represents the remaining 45% of annual CO<sub>2</sub> emissions associated with buildings. Investments in urban transport infrastructure – the roads to carry vehicles, plus the vehicles themselves – contribute about 4 Gt, or more than 25%, of urban CO<sub>2</sub> emissions each year. Half of this is due to expansion of urban form, the remainder to inefficient or carbon-intensive vehicles.

## A great opportunity to shift to a low carbon development pathway and minimize further lock-in, led by cities.

Substantial opportunities exist to minimise building emissions, especially through regulations for new buildings that limit energy consumption. For example, our research shows that heating and cooling demand from new buildings and equipment can be reduced by 20% compared with the business as usual (BAU) scenario, and by more than 50% by 2030. In the transport sector, compact urban forms could reduce private passenger vehicle travel by 20% community-wide compared with the reference (BAU) case by 2030.



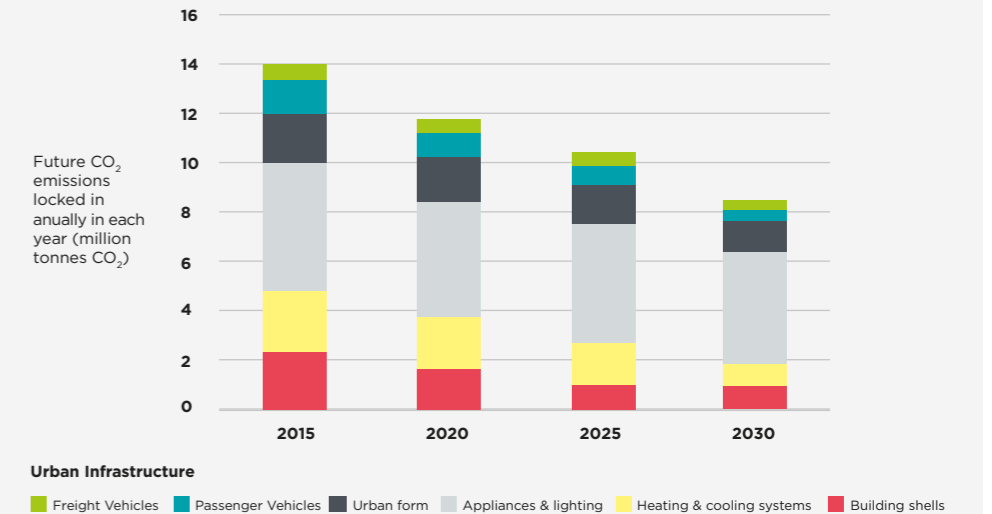
Cities can avoid locking in 45 Gt CO<sub>2</sub> by 2030, this is 8 times the total current annual emissions of the US

## Impact of avoiding lock-in.

As Figure 2 shows, by making decisions towards a low carbon development path, city leaders can avoid urban development using up the remaining 200 Gt of carbon budget by 2020. Of course, climate action needs to continue for much more than the next five years. By continuing on a low carbon path out to 2030, cities can avoid locking in 45 Gt CO<sub>2</sub> – that is more than 8 times the current annual emissions of the United States.

Indeed, cities have the power to take transformative climate action<sup>2</sup> and as C40 research shows, are doing so at an ever-increasing scale. Cities are also demonstrating their continued commitment and leadership through pioneering initiatives like the Compact of Mayors, which provides the largest common platform for cities to publicly report their emissions inventory, targets and action plans to cut emissions and improve resilience<sup>3</sup>.

**Figure 2: Future CO<sub>2</sub> emissions assuming city action for a low carbon development future**



Great opportunity to minimize further lock-in by jumping straight to a low carbon development path, particularly for cities in the Global South

## There is a unique opportunity in cities with high population growth to avoid historical high carbon development.

And for industrialised cities to retrofit and renew in order to mitigate or "unlock" emissions from existing infrastructure. Action is needed on both fronts.

The opportunity to impact future emissions through new infrastructure development is greatest in the fast growing cities of the Global South which can "leapfrog" directly to low carbon solutions. Under a business as usual development trajectory, cities in non-OECD countries represent about 70% of the urban emissions locked-in until 2030 for appliances and lighting. Heating and cooling equipment and building shells are more evenly split between cities in OECD and non-OECD countries, since many cities in OECD countries, though not growing as rapidly, have colder climates and correspondingly greater demand for heating.

<sup>2</sup> Powering Climate Action [http://issuu.com/c40cities/docs/powering\\_climate\\_action\\_full\\_report](http://issuu.com/c40cities/docs/powering_climate_action_full_report)  
<sup>3</sup> Compact of Mayors <http://www.compactofmayors.org>



**Cities of the Global North must lead on unlocking the current 800 Gt of locked-in carbon**

The large majority (~80%) of future transport CO<sub>2</sub> emissions are likely to occur in cities in non-OECD countries, many of which are rapidly expanding into surrounding peri-urban and rural areas.

While this report focuses on the 200 Gt CO<sub>2</sub> that is not already 'locked-in', there remains also the challenge and opportunity of un-locking the 800 Gt CO<sub>2</sub> that will be emitted if existing high carbon infrastructure serves out its natural life. Developed cities can play a major role in this by shifting to a low-carbon growth pathway, in which decommissioning and retrofitting existing infrastructure will be as important and investing in new green infrastructure.

## Win-win: low carbon development and economic growth go hand in hand.

By investing in low carbon solutions today, cities are reducing the longer-term economic cost of retrofits and climate change impacts. According to calculations by the International Energy Authority (IEA) choosing low carbon infrastructure will be four times more cost effective than retrofitting infrastructure and assets in the coming decades<sup>4</sup>. As previously stated, it is simply more expensive to retrofit buildings later than to build them to stringent low-energy standards the first time. Economic analysis of the global urban action scenario has found that actions in the building sector represent an economic opportunity (net cost savings, on an NPV basis) of 170 billion USD annually<sup>5</sup>.

## Conclusion

To avoid dangerous levels of global warming, transformative action is required urgently across the globe. We have five years to act. Cities can lead this effort, as they are directly able to influence a third of the relevant future investments and policy decisions, and they are also able to move quickly to implement policies and programmes on the ground.

Preventing such warming will require a firm strategy for avoiding high carbon lock in from new growth, and unlocking projected emissions from previous development. Many C40 and non-C40 cities are already delivering firm climate action that is cutting emissions and hundreds are making ambitious commitments to action under the Compact of Mayors. Mayors do not have to wait for the outcome of treaties and talks to take action.

## Methodology

Please see Keeping cities green: Avoiding carbon lock-in due to urban development (Erikson and Tempest, 2015) for details of the analysis approach undertaken in support of this study.

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**4x more cost effective to choose low carbon options than retrofitting**

<sup>4</sup> IEA (2013b). Redrawing the Energy-Climate Map: World Energy Outlook Special Report. International Energy Agency, Paris. <https://www.iea.org/publications/freepublications/publication/weo-special-report-2013-redrawing-the-energy-climate-map.html>.  
<sup>5</sup> (Gouldson et al. 2015)



**The C40 Cities Climate Leadership Group, now in its 10th year, connects more than 80 of the world's greatest cities, representing 600+ million people and one quarter of the global economy.**

**Created and led by cities, C40 is focused on tackling climate change and driving urban action that reduces greenhouse gas emissions and climate risks, while increasing the health, wellbeing and economic opportunities of urban citizens.**

C40 is proud to be supported by our core funders:

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